What is Claimed is

[c1] 1.A method for providing a corrective modulation signal to suppress an acoustic pressure wave in an operational system, the method comprising the steps of:
sampling the acoustic pressure wave generated in the operational system;
sampling a previously generated corrective modulation signal, the previously generated corrective modulation signal having parameters;
performing fast Fourier transform processing on the sampled acoustic pressure wave;
performing a pair of single frequency discrete Fourier transform processing on the sampled acoustic pressure wave;
determining the frequency, phase and magnitude of a dominate pressure wave in the acoustic pressure wave based on the fast Fourier transform processing and the discrete Fourier transform processing; and
generating a sinusoidal corrective modulation signal to suppress the acoustic pressure wave based on the frequency, phase and magnitude of the dominate pressure wave and the parameters of the previously generated corrective modulation signal, the corrective modulation signal being at substantially the same frequency as, and generally 180 degrees out of phase with, the acoustic pressure wave.

[c2] 2.The method of claim 1, wherein the operational system is a gas turbine.

[c3] 3. The method of claim 1, wherein the corrective modulation signal is generated at a 180 degree relationship to the acoustic pressure wave.

[c4] 4.The method of claim 1, wherein the sampling is performed using a pressure transducer.

[c5] 5.The method of claim 1, further including the step of providing a gain control, the gain control generating a gain signal to adjust the corrective modulation signal.

[c6] 6.The method of claim 1, wherein the step of performing fast Fourier transform processing on the sampled acoustic pressure wave is performed in conjunction with using a mathematical windowing process; and

the step of performing a pair of single frequency discrete Fourier transform processing on the sampled acoustic pressure wave is performed in conjunction with using a mathematical windowing process.

[c7] 7.The method of claim 1, further including the steps of:
generating a corrected phase error, the corrected phase error being processed in conjunction with the step of generating a corrective modulation signal; and
generating a frequency error, the frequency error being processed with the corrected phase error.

[c8] 8.A corrective modulation system for providing a corrective modulation signal to suppress an acoustic pressure wave in an operational system, the system comprising:
a pressure sampling device that samples the acoustic pressure wave generated in the operational system to provide a sample of the acoustic pressure wave;
a phase output portion, the phase output portion providing a sample of a phase of a previously generated corrective modulation;
a signal processing portion that processes the sample of the acoustic pressure wave and the sample of the phase of the previously generated corrective modulation, the signal processing portion including:

a fast Fourier transform processing portion that performs a fast Fourier transform process on the sample of the acoustic pressure wave, the signal processing portion generating frequency with maximum power information and maximum power information based on the fast Fourier transform process;

at least two discrete Fourier transform processing portions that perform single frequency discrete Fourier transform processing, the signal processing portion generating pressure phase information based on the single frequency discrete Fourier transform processing, and

a modulation phase processing portion, the modulation phase processing portion generating modulation phase information based on the sample of the phase of the previously generated corrective modulation; and

a corrective modulation generator that generates a sinusoidal corrective modulation signal to suppress the acoustic pressure wave based on the

frequency with maximum power information and maximum power information, the pressure phase information, and the modulation phase information, wherein the corrective modulation signal being at substantially the same frequency as, and generally 180 degrees out of phase with, the acoustic pressure wave.

[c9] 9.The corrective modulation system of claim 8, wherein the operational system is a gas turbine.

[c10] 10.The corrective modulation system of claim 8, wherein the phase output portion is a phase register.

[c11] 11. The corrective modulation system of claim 10, further including a direct memory addressing unit, the direct memory addressing unit processing the acoustic pressure wave generated in the operational system, that is input from the pressure sampling device, and processing the sample of the phase of the previously generated corrective modulation, that is input from the phase register.

[c12] 12.The corrective modulation system of claim 11, wherein the direct memory addressing unit inputs pairs of simultaneous samples from the pressure sampling device and from the phase register.

[c13] 13. The corrective modulation system of claim 12, wherein the direct memory addressing unit inputs 2048 pairs of simultaneous samples from the pressure sampling device and from the phase register.

[c14] 14.The corrective modulation system of claim 8, wherein the signal processing portion uses respective mathematical windowing processes in conjunction with the fast Fourier transform process performed by the fast Fourier transform processing portion and the single frequency discrete Fourier transform processing performed by the at least two discrete Fourier transform processing portions.

[c15] 15.The corrective modulation system of claim 8, wherein the corrective modulation generator is a field programmable gate array.

[c16] 16.The corrective modulation system of claim 8, wherein the pressure sampling

device is a differential pressure transducer.

[c17] 17.The corrective modulation system of claim 16, wherein the operational system is a gas turbine having a combustion chamber, the pressure sampling device being placed within the combustion chamber.

[c18] 18.The corrective modulation system of claim 8, the system further including an automatic gain control, the automatic gain control outputting a gain signal to the corrective modulation generator such that the corrective modulation generator may adjust the corrective modulation signal.

[c19] 19.The corrective modulation system of claim 18, wherein the gain signal is proportional to a maximum power of the acoustic pressure wave, the gain signal resulting in a remnant of the acoustic pressure wave being left.

[c20] 20.The corrective modulation system of claim 8, wherein:

the single frequency discrete Fourier transform processing, performed by the at least two discrete Fourier transform processing portions, includes performing a first single frequency discrete Fourier transform on a first part of the sample of the acoustic pressure wave, which is processed by the signal processing portion to generate pressure phase $_{K}$ information, and performing a second single frequency discrete Fourier transform on a second part of the sample of the acoustic pressure wave, which is processed by the signal processing portion to generate pressure phase $_{K-1}$ information, and

the modulation phase information, generated by the modulation phase processing portion, includes modulation phase $_{K}$ information and modulation phase $_{K-1}$ information; and

the corrective modulation generator generates the sinusoidal corrective modulation signal to suppress the acoustic pressure wave based on:

the frequency with maximum power information and maximum power information;

the pressure phase $_{K}$ information and the pressure phase $_{K-1}$ information; and

modulation phase $_{K}$ information and modulation phase $_{K-1}$ information.

[c21] 21.The corrective modulation system of claim 20, wherein the at least two discrete Fourier transform processing portions includes:

a first fast Fourier transform processing portion that performs a fast Fourier transform process on the first part of the sample of the acoustic pressure wave;

a second fast Fourier transform processing portion that performs a fast Fourier transform process on the second part of the sample of the acoustic pressure wave.

[c22] 22.The corrective modulation system of claim 20, wherein:

the pressure phase $_K$ information is compared with the modulation phase $_K$ information, by the signal processing portion, to generate a corrected phase error and a frequency error; and

the pressure phase $_{K-1}$ information is compared with the modulation phase $_{K-1}$ information, by the signal processing portion, to generate the frequency error.

[c23] 23.A system for providing a corrective modulation signal to suppress an acoustic pressure wave in an operational system, the system comprising:

means for sampling the acoustic pressure wave generated in the operational system;

means for sampling a previously generated corrective modulation signal, the previously generated corrective modulation signal having parameters;

means for performing fast Fourier transform processing on the sampled acoustic pressure wave;

means for performing a pair of single frequency discrete Fourier transform processing on the sampled acoustic pressure wave;

means for determining the frequency, phase and magnitude of a dominate pressure wave in the acoustic pressure wave based on the fast Fourier transform processing and the discrete Fourier transform processing; and

means for generating a sinusoidal corrective modulation signal to suppress the acoustic pressure wave based on the frequency, phase and magnitude of the dominate pressure wave and the parameters of the previously generated corrective modulation signal, the corrective modulation signal being at substantially the same frequency as, and generally 180 degrees out of phase with, the acoustic pressure wave.

[c24] 24.A method for providing a corrective modulation signal to suppress an acoustic pressure wave in a gas turbine system, the method comprising the steps of:

sampling the acoustic pressure wave generated in the gas turbine system;

sampling a previously generated corrective modulation signal, the previously generated corrective modulation signal having parameters;

performing fast Fourier transform processing on the sampled acoustic pressure wave;

performing a pair of single frequency discrete Fourier transform processing on the sampled acoustic pressure wave;

determining the frequency, phase and magnitude of a dominate pressure wave in the acoustic pressure wave based on the fast Fourier transform processing and the discrete Fourier transform processing;

generating a sinusoidal corrective modulation signal to suppress the acoustic pressure wave based on the frequency, phase and magnitude of the dominate pressure wave and the parameters of the previously generated corrective modulation signal, the corrective modulation signal being at substantially the same frequency as, and generally 180 degrees out of phase with, the acoustic pressure wave;

generating a frequency error;

generating a phase error; and

providing a gain control based on the frequency error, the phase error and the magnitude of the dominate pressure wave, the gain control generating a gain signal to adjust the corrective modulation signal.

[c25] 25.The method of claim 24, wherein the sampling is performed using a pressure transducer.

[c26] 26.The method of claim 24, wherein the step of performing fast Fourier transform processing on the sampled acoustic pressure wave is performed in conjunction with using a mathematical windowing process; and

the step of performing a pair of single frequency discrete Fourier transform processing on the sampled acoustic pressure wave is performed in conjunction with using a mathematical windowing process.

[c27] 27.The method of claim 24, further including the steps of:
generating a corrected phase error, the corrected phase error being processed in conjunction with the step of generating a corrective modulation signal; and
generating a frequency error, the frequency error being processed with the corrected phase error.

[c28] 28.A corrective modulation system for providing a corrective modulation signal to suppress an acoustic pressure wave in an operational system, the system comprising:
a pressure sampling device that samples the acoustic pressure wave generated in the operational system to provide a sample of the acoustic pressure wave;
a phase output portion, the phase output portion providing a sample of a previously generated corrective modulation;
a signal processing portion that processes the sample of the acoustic pressure wave and the sample of the previously generated corrective modulation, the signal processing portion including:

a fast Fourier transform processing portion that performs a fast Fourier transform process on the sample of the acoustic pressure wave, the signal processing portion generating frequency with maximum power information and maximum power information based on the fast Fourier transform process;

at least one discrete Fourier transform processing portion that performs single frequency discrete Fourier transform processing, the single frequency discrete Fourier transform processing including performing a first single frequency discrete Fourier transform on a first part of the sample, which is processed by the signal processing portion to generate pressure phase $_{K}$ information, and performing a second single frequency discrete Fourier transform on a second part of the sample, which is processed by the signal processing portion to generate pressure phase $_{K-1}$ information, and

a modulation phase processing portion, the modulation phase processing portion generating modulation phase $_{K}$ information and modulation phase $_{K-1}$ information based on the sample of the previously generated

corrective modulation;

a corrective modulation generator that generates a sinusoidal corrective modulation signal to suppress the acoustic pressure wave based on:

the frequency with maximum power information and maximum power information;

the pressure phase $_{K}$ information and the pressure phase $_{K-1}$ information; and

modulation phase $_{K}$ information and modulation phase $_{K-1}$ information; and

the corrective modulation signal being at substantially the same frequency as, and generally 180 degrees out of phase with, the acoustic pressure wave.

[c29]

29.A system for providing a corrective modulation signal to suppress an acoustic pressure wave in a gas turbine, the system comprising:

means for sampling the acoustic pressure wave generated in the gas turbine;

means for sampling a previously generated corrective modulation signal, the previously generated corrective modulation signal having parameters;

means for performing fast Fourier transform processing on the sampled acoustic pressure wave;

means for performing a pair of single frequency discrete Fourier transform processing on the sampled acoustic pressure wave;

means for determining the frequency, phase and magnitude of a dominate pressure wave in the acoustic pressure wave based on the fast Fourier transform processing and the discrete Fourier transform processing;

means for generating a sinusoidal corrective modulation signal to suppress the acoustic pressure wave based on the frequency, phase and magnitude of the dominate pressure wave and the parameters of the previously generated corrective modulation signal, the corrective modulation signal being at substantially the same frequency as, and generally 180 degrees out of phase with, the acoustic pressure wave;

means for generating a frequency error;

means for generating a phase error; and

means for providing a gain control based on the frequency error, the phase

error and the magnitude of the dominate pressure wave, the gain control generating a gain signal to adjust the corrective modulation signal.